

## THE CLAIMS

What is claimed is:

1. A vapor delivery system for vaporization and delivery of a vaporized source material comprising a vaporization vessel enclosing an interior volume, wherein the vaporization vessel comprises a heating means for vaporizing a source material; an inlet port for introducing a source material and an outlet port for discharging vaporized source material; a processing tool positioned downstream from the vaporization vessel; a connecting vapor line positioned between the vaporization vessel and processing tool and in fluid communication therewith; and additionally at least one flow control feature comprising:

- a) a mass flow controller in fluid communication with the connecting vapor line to provide a controlled flow of vaporized source material from the vaporization vessel to the processing tool;
- b) a constant flow control valve in fluid communication with the connecting vapor line, wherein the control valve has an orifice sized to provide a controlled and constant flow of vaporized source material to the processing tool via the connecting vapor line;
- c) an adjustable needle valve connected to the outlet port of the vaporization vessel, wherein the opening of the needle valve is continuously adjusted based on the vapor pressure within the vaporization vessel to provide a controlled and constant flow of vaporized source material to the processing tool via the

connecting vapor line;

d) a Knudsen cell structure integral to the vaporization vessel or connected to the outlet port of the vaporization vessel, wherein the Knudsen cell has an orifice sized to provide a controlled and constant flow of vaporized source material to processing tool via the connecting vapor line;

e) a syringe system for accurately delivering a controlled amount of a liquid source material into the vaporization vessel for vaporization therein; or

f) a screw delivery device for accurately delivering a solid source material into the vaporization vessel for vaporization therein.

2. The vapor delivery system according to claim 1, wherein the system comprises Knudsen cell structure integral to the vaporization vessel.

3. The vapor delivery system according to claim 1, further comprising a central processing unit communicatively linked to the at least one control feature for adjustment of flow into or out of the vaporization vessel.

4. The vapor delivery system according to claim 1, further comprising a carrier gas source in fluid communication with the vaporization vessel.

5. The vapor delivery system according to claim 1, wherein the system comprises a Knudsen cell structure connected to the outlet port of the vaporization vessel.

6. The vapor delivery system according to claim 1 further comprising a heating means for heating the connecting vapor line.

7. The vapor delivery system according to claim 1, wherein the system comprises the mass flow controller and the screw delivery device.

8. The vapor delivery system according to claim 6, wherein the heating means is selected from the group consisting of electrical, liquid, electromagnetic radiation having wavelengths from  $10^{-2}$  to  $10^{-8}$  meters;

9. The vapor delivery system according to claim 1, wherein the system comprises the constant flow control valve and the system is heated by an ultrasonic laser positioned adjacent to the vaporization vessel.

10. The vapor delivery system according to claim 1, wherein the system comprises a Knudsen cell structure connected to the outlet port of the vaporization vessel and a mass flow control valve.

11. A vapor delivery system for vaporization delivery of a vaporized source material, comprising:

- a) a vaporization vessel for holding a vaporizable source material comprising an input port for introducing a source material and an outlet port for discharging vaporized source material; and a vaporization means for vaporizing the

vaporizable source material, wherein the vaporization means is selected from the group consisting of an electrical energy emitting device, a liquid heating medium and electromagnetic radiation device emitting wavelengths ranging from about  $10^{-2}$  to about  $10^{-8}$  meters;

- b) a processing tool positioned downstream from the vaporization vessel;
- c) a connecting vapor line positioned between the vaporization vessel and processing tool and in fluid communication therewith; and additionally at least one of the features of:

- 1) a mass flow controller in fluid communication with the connecting vapor line to provide a controlled flow of vaporized source material from the vaporization vessel to the processing tool;
- 2) a constant flow control valve in fluid communication with the connecting vapor line, wherein the constant flow control valve has an orifice sized to provide a controlled and constant flow of vaporized source material to the processing tool via the connecting vapor line;
- 3) an adjustable needle valve connected to the outlet port of the vaporization vessel, wherein the opening of the needle valve is continuously adjusted based on the vapor pressure within the vaporization vessel to provide a controlled and constant flow of vaporized source material to the processing tool via the connecting vapor line;
- 4) a Knudsen cell structure integral to the vaporization vessel or connected to the outlet port of the vaporization vessel, wherein the

Knudsen cell has an orifice sized to provide a controlled and constant flow of vaporized source material to processing tool via the connecting vapor line

5) a syringe-type pump system for accurately delivering a controlled amount of a liquid source material into the vaporization vessel for vaporization therein; or

6) a screw delivery device for accurately delivering a solid source material into the vaporization vessel for vaporization therein.

12. The vapor delivery system according to claim 11, wherein the system comprises a syringe for introducing a control amount of source material to the vaporization vessel and a mass flow controller for controlling the amount of vaporized source material introduced into process tool.

13. The vaporized delivery system according to claim 12, wherein the heating means comprises resistance heating means.

14. The vapor delivery system according to claim 11, wherein the system comprises a syringe for introducing a control amount of source material to the vaporization vessel and a Knudsen-type-cell structure for controlling the amount of vaporized source material introduced into process tool.

15. The vapor delivery system according to claim 11, wherein the system comprises a

screw device for introducing a control amount of source material to the vaporization vessel and a Knudsen-type-cell structure for controlling the amount of vaporized source material introduced into process tool.

16. The vapor delivery system according to claim 15, wherein the heating means to heat the Knudsen-type-cell structure comprises resistance heating means.

17. A vapor delivery system for vaporization and delivery of a vaporized source material, the system comprising:

- a) a vaporization vessel for holding a vaporizable source material comprising an input port for introducing a source material; an outlet port for discharging vaporized source material; and vaporization means for vaporizing the vaporizable source material within the vaporized vessel;
- b) a processing tool positioned downstream from the vaporization vessel;
- c) a connecting vapor line positioned between the vaporization vessel and processing tool and in fluid communication therewith;
- d) input flow control means for introducing a constituent and reproducible flow of a vaporizable source material into the vaporization vessel; and
- e) output flow control means for delivering a constant flow rate of the vaporized source material from the vaporization vessel to the processing tool.

18. The vapor delivery system according to claim 17, wherein the system comprises a syringe for introducing a control amount of source material to the vaporization vessel and a

constant control valve for controlling the amount of vaporized source material introduced into process tool.

19. The vapor delivery system according to claim 17, wherein the system comprises a screw delivery device for introducing a control amount of source material to the vaporization vessel and a Knudsen-type-cell structure for controlling the amount of vaporized source material introduced into process tool.

20. The vapor delivery system according to claim 19, wherein the vaporization means comprises ultrasonic energy.

21. A method for delivering a vaporized source material to a processing tool, the method comprising:

- a) introducing a controlled flow of a vaporizable source material in a vaporization vessel;
- b) vaporizing a source material in the vaporization vessel to generate a vaporized source material;
- c) discharging the vaporized source material from the vaporization vessel; and
- d) adjusting the flow rate of the discharged vaporized source material by passage thereof through a flow controller to provide a controlled and constant flow of source material to the processing tool.

22. The method according to claim 21, wherein the flow controller is a mass flow controller.

23. The method according to claim 22, further comprising linking the mass flow controller to the central processing unit for adjusting the flow of the discharged gas into the processing tool.

24. The method according to claim 22, wherein the flow controller is a Knudsen cell structure.